REMARKS

Reconsideration of claims 1-8, 10-14, 16, 17, 20, 22-37 and 39-42 is respectfully requested. Claims 13, 14, 19, 20, 22, 24, 35, 41 and 42 are amended. Claim 38 is canceled. Claims 1-8, 10-12, 16, 17, 20, 22-34, 39 and 40 have been allowed. Claims 20, 22 and 24 were placed in independent form.

The rejection of claims 35-38 under 35 USC § 112, first paragraph is respectively traversed with respect to the amended claims. Claim 38 is canceled. Amended claim 35 recites a compositional range for the oxygen exchange layer. With respect to the composition of the oxide, any oxide with the claimed oxide diffusivity and porosity as described on page 34, line 27 to page 35, line 21 will enable one skilled in the art to practice the invention. The specification even describes how the porosity of the particular oxide is to be measured. Also, specific porous oxides that can be used are described on page 20, line 22 to page 23, line 9. Applicants are not required to list all of the porous oxides that can be used to practice the invention in order to satisfy the enablement requirement. Accordingly, Applicants respectfully request that the rejection be withdrawn.

The rejection of claims 41 and 42 under 35 USC § 112, first paragraph is respectively traversed with respect to the amended claims. The amended claims recite a mixed conducting layer of specified composition. Following the discussion with the examiner, Applicants added the term "sintered" to describe the porous body portion and film portion. The added terms clarify that the porous body portion is subject to a heat treatment prior to forming the film portion on the porous body. The deposited film and the porous body is then subjected to a second heat treatment to provide a sintered film portion. Accordingly, Applicants respectfully request that the rejection be withdrawn.

Withdrawal of the rejection of claims 13-14, 19 and 41-42 under 35 USC § 112, second paragraph is respectfully requested. Claim 19 was amended to better define how the composite material is produced. Applicants believe the claim amendments overcome the stated rejections.

Attached hereto is a marked-up version of the changes made to the specification and claims by the current amendment. The attached page is captioned **"Version with markings to show changes made."**

In view of the above, each of the presently pending claims in this application is believed to be in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to withdraw the outstanding rejection of the claims and to pass this application to issue.

Application No.: 09/695,232 Docket No.: 21776-00055-US

The Director is hereby authorized to charge any fees, or credit any overpayment, associated with this communication, including any extension fees, to CBLH Deposit Account No. 22-0185.

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Respectfully submitted,

By

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Version With Markings to Show Changes Made

In the Claims

Claim 38 is canceled.

Claims 13, 14, 19, 20, 22, 24, 35, 41 and 42 were amended as follows.

13. (Twice Amended) A composite material comprising a porous body portion comprising a mixed conducting oxide, and a film portion including a dense continuous layer of a mixed conducting oxide formed on said porous body portion, wherein [the maximum heat treatment temperature for said porous body portion is higher than that for said dense continuous layer, and]

said porous body portion comprises a ceramic composition as a mixed conducting oxide in perovskite structure, said composition being expressed by the following general formula (1):

$$\{Ln_{1-a}A_a\}\ \{B_xB'_yB''_z\}\ O_{(3-\delta)} \qquad (1)$$

where Ln represents one or a combination of elements selected from the group of Y and lanthanoids;

A represents one or a combination of elements selected from the group of Ba, Sr, and Ca;

B represents one or a combination of elements selected from the group of Co, Fe, Cr, and Ga, B always containing Fe or Co, the sum of the molar numbers of Cr and Ga being within the range of 0% to 20% of the total molar number x of B;

B' represents one or a combination of elements selected from the group of Nb, Ta, Ti, and Zr, B' always containing Nb or Ta, the sum of the molar numbers of Ti and Zr being within the range of 0% to 20% of the total molar number y and B';

B″ represents one or a combination of elements selected from the group of Cu, Ni, Zn, Li, and Mg;

$0.8 \leq a \leq 1$; $0 < x$; $0 < y \leq 0.5$; $0 \leq z \leq 0.2$

$0.98 \leq x + y + z \leq 1.02$; and

δ represents a value which is so determined as to meet charge neutralization conditions.

14. (Twice Amended) A composite material comprising a porous body portion comprising a mixed conducting oxide, and a film portion including a dense continuous layer of a mixed conducting oxide formed on said porous body portion, wherein [the maximum heat treatment temperature for said oxide material of said porous body portion is higher than that for said dense continuous layer, and]

said porous body portion comprises a ceramic composition as a mixed conducting oxide in perovskite structure, said composition being expressed by the following general formula (1):

$$\{Ln_{1-a}A_a\}\ \{B_xB'_yB''_z\}\ O_{(3-\delta)} \qquad (1)$$

where Ln represents one or a combination of elements selected from the group of Y and lanthanoids;

A represents one or a combination of elements selected from the group of Ba, Sr, and Ca;

B represents one or a combination of elements selected from the group of Co, Fe, Cr, and Ga, B always containing Fe, the molar number of Co being within the range of 0% to 10% of the total molar number of Fe, the sum of the molar numbers of Cr and Ga being within the range of 0% to 20% of the total molar number x of B;

B' represents one or a combination of elements selected from the group of Nb, Ta, Ti, and Zr, B' always containing Nb or Ta, the sum of the molar numbers of Ti and Zr being within the range of 0% to 20% of the total molar number y and B';

B" represents one or a combination of elements selected from the group of Zn, Li, and Mg;

$0.8 \leq a \leq 1$; $0 < x$; $0 < y \leq 0.5$; $0 \leq z \leq 0.2$

$0.98 \leq x + y + z \leq 1.02$; and

δ represents a value which is so determined as to meet charge neutralization conditions.

19. (Amended) A method of producing a composite material [which comprises], the method comprising:

providing a porous body portion including a mixed conducting oxide, [and a film portion including a gastight dense continuous layer of a mixed conducting oxide formed on said porous body portion,] said mixed conducting oxide of said porous body portion comprising [a porous body portion comprising] a mixed conducting oxide expressed by the following general formula (2):

$$AFe_xO_{(3-\delta)} \qquad (2)$$

where $0.98 \leq x \leq 1.02$; A represents one or a combination of elements selected from the group of Bs, Sr, and Ca; and δ represents a value which is so determined as to meet charge neutralization conditions,

[wherein] subjecting said porous body portion [is subjected] to a heat treatment, the maximum temperature [for which is in the range of 1200 °C to] not to exceed 1400°C[, and];

forming a film portion including a gastight dense continuous layer of a mixed conducting oxide on said porous body portion; and

subjecting said dense continuous layer [is subjected] to a heat treatment, the maximum temperature for which is lower than [that] the maximum temperature for said porous body portion by 20°C or more.

20. (Amended) A composite material [according to claim 13] comprising:

a porous body portion comprising a mixed conducting oxide, and a film portion including a dense continuous layer of a mixed conducting oxide formed on said porous body portion, wherein said porous body portion comprises a ceramic composition as a mixed conducting oxide in perovskite structure, said composition being expressed by the following general formula (1):

$$\{Ln_{1-a}A_a\}\{B_xB'_yB''_z\}O_{(3-\delta)} \qquad (1)$$

where Ln represents one or a combination of elements selected from the group of Y and lanthanoids;

A represents one or a combination of elements selected from the group of Ba, Sr, and Ca;

B represents one or a combination of elements selected from the group of Co, Fe, Cr, and Ga, B always containing Fe or Co, the sum of the molar numbers of Cr and Ga being within the range of 0% to 20% of the total molar number x of B;

B' represents one or a combination of elements selected from the group of Nb, Ta, Ti, and Zr, B' always containing Nb or Ta, the sum of the molar numbers of Ti and Zr being within the range of 0% to 20% of the total molar number y and B';

B″ represents one or a combination of elements selected from the group of Cu, Ni, Zn, Li, and Mg;

$0.8 \leq a \leq 1$; $0 < x$; $0 < y \leq 0.5$; $0 \leq z \leq 0.2$

$0.98 \leq x + y + z \leq 1.02$; and

δ represents a value which is so determined as to meet charge neutralization conditions; and wherein said dense continuous layer is made of a ceramic of a mixed conducting oxide having its composition expressed by the following general formula (3):

$$\{Ln_{1-a}A_a\}\ \{B_xB'_y\}\ O_{(3-\delta)} \qquad (3)$$

where Ln represents one or a combination of elements selected from the group of Y and lanthanoids;

A represents one or a combination of elements selected from the group of Ba, Sr, and Ca;

B represents one or a combination of elements selected from the group of Fe and Co,

B' represents one or a combination of elements selected from the group of Cu, Ni, Zn, Li, and Mg;

$0.8 \leq a \leq 1$; $0 < x$; $0 < y \leq 0.2$;

$0.98 \leq x + y \leq 1.02$; and

δ represents a value which is so determined as to meet charge neutralization conditions.

22. (Amended) A composite material [according to claim 14] comprising:

a porous body portion comprising a mixed conducting oxide, and a film portion including a dense continuous layer of a mixed conducting oxide formed on said porous body portion, wherein said porous body portion comprises a ceramic composition as a mixed conducting oxide in perovskite structure, said composition being expressed by the following general formula (1):

$$\{Ln_{1-a}A_a\}\ \{B_xB'_yB''_z\}\ O_{(3-\delta)} \qquad (1)$$

where Ln represents one or a combination of elements selected from the group of Y and lanthanoids;

A represents one or a combination of elements selected from the group of Ba, Sr, and Ca;

B represents one or a combination of elements selected from the group of Co, Fe, Cr, and Ga, B always containing Fe, the molar number of Co being within the range of 0% to 10% of the total molar number of Fe, the sum of the molar numbers of Cr and Ga being within the range of 0% to 20% of the total molar number x of B;

B' represents one or a combination of elements selected from the group of Nb, Ta, Ti, and Zr, B' always containing Nb or Ta, the sum of the molar numbers of Ti and Zr being within the range of 0% to 20% of the total molar number y and B';

B" represents one or a combination of elements selected from the group of Zn, Li, and Mg;

$0.8 \leq a \leq 1; 0 < x; 0 < y \leq 0.5; 0 \leq z \leq 0.2$

$0.98 \leq x + y + z \leq 1.02$; and

δ represents a value which is so determined as to meet charge neutralization conditions; and wherein said dense continuous layer is made of a ceramic of a mixed conducting oxide having its composition expressed by the following general formula (3):

$$\{Ln_{1-a}A_a\}\ \{B_xB'_y\}\ O_{(3-\delta)} \qquad (3)$$

where Ln represents one or a combination of elements selected from the group of Y and lanthanoids;

A represents one or a combination of elements selected from the group of Ba, Sr, and Ca;

B represents one or a combination of elements selected from the group of Fe and Co,

B' represents one or a combination of elements selected from the group of Cu, Ni, Zn, Li, and Mg;

$0.8 \leq a \leq 1; 0 < x; 0 < y \leq 0.2$;

$0.98 \leq x + y \leq 1.02$; and

δ represents a value which is so determined as to meet charge neutralization conditions.

24. (Amended) A composite material [according to claim 13, wherein] comprising:

a porous body portion comprising a mixed conducting oxide, and a film portion including a dense continuous layer of a mixed conducting oxide formed on said porous body portion, wherein said porous body portion and said dense continuous layer [is] are made of a ceramic composition as a mixed conducting oxide in perovskite structure, said composition being expressed by the following general formula (1):

$$\{Ln_{1-a}A_a\}\ \{B_xB'_yB''_z\}\ O_{(3-\delta)} \qquad (1)$$

where Ln represents one or a combination of elements selected from the group of Y and lanthanoids;

A represents one or a combination of elements selected from the group of Ba, Sr, and Ca;

B represents one or a combination of elements selected from the group of Co, Fe, Cr, and Ga, B always containing Fe or Co, the sum of the molar numbers of Cr and Ga being within the range of 0% to 20% of the total molar number x of B;

B' represents one or a combination of elements selected from the group of Nb, Ta, Ti, and Zr, B' always containing Nb or Ta, the sum of the molar numbers of Ti and Zr being within the range of 0% to 20% of the total molar number y and B';

B" represents one or a combination of elements selected from the group of Cu, Ni, Zn, Li, and Mg;

$0.8 \leq a \leq 1$; $0 < x$; $0 < y \leq 0.5$; $0 \leq z \leq 0.2$

$0.98 \leq x + y + z \leq 1.02$; and

δ represents a value which is so determined as to meet charge neutralization conditions.

35. (Twice Amended) A composite material [wherein] comprising an oxygen exchange layer [is formed on a surface of one or either side] disposed on one side or two sides of an oxide having oxide ion diffusivity and porosity from 20% to 80%, wherein said oxygen exchange layer [being made of an oxide] comprises an oxide expressed by $La_uSr_{b-u}Fe_vCo_{c-v}O_{3-w}$,

wherein $0.1 \leq u < 0.5$, $0.9 < b < 1.1$ $0 < v < 1.1$, and $0.9 < c < 1.1$, and is of different oxide composition than said oxide having oxide ion diffusivity.

41. (Twice Amended) A method of making a composite material for the separation of oxygen from a mixed gas, comprising:

providing a sintered, porous body portion comprising a mixed conducting oxide, wherein said porous body portion comprises a ceramic composition as a mixed conducting oxide in perovskite structure, said composition being expressed by the following general formula (1):

$$\{Ln_{1-a}A_a\}\ \{B_xB'_yB''_z\}\ O_{(3-\delta)} \qquad (1)$$

where Ln represents one or a combination of elements selected from the group of Y and lanthanoids;

A represents one or a combination of elements selected from the group of Ba, Sr, and Ca;

B represents one or a combination of elements selected from the group of Co, Fe, Cr, and Ga, B always containing Fe, the molar number of Co being within the range of 0% to 10% of the total molar number of Fe, the sum of the molar numbers of Cr and Ga being within the range of 0% to 20% of the total molar number x of B;

B' represents one or a combination of elements selected from the group of Nb, Ta, Ti, and Zr, B' always containing Nb or Ta, the sum of the molar numbers of Ti and Zr being within the

range of 0% to 20% of the total molar number y and B';

B" represents one or a combination of elements selected from the group of Zn, Li, and Mg;

$0.8 \leq a \leq 1; 0 < x; 0 < y < 0.5; 0 \leq z \leq 0.2$

$0.98 \leq x + y + z \leq 1.02$; and

δ represents a value which is so determined as to meet charge neutralization conditions; and

[providing] forming a sintered film portion including a gastight dense continuous layer of a mixed conducting oxide [formed] on said porous body portion, wherein the maximum [heat treatment] sintering temperature for said mixed conducting oxide of porous body portion [includes sintering at a higher] is greater than the maximum sintering temperature [than that of] for said dense continuous layer.

42. (Twice Amended) A method of making a composite material for use as a chemical reactor, comprising:

providing a sintered, porous body portion comprising a mixed conducting oxide, wherein said porous body portion comprises a ceramic composition as a mixed conducting oxide in perovskite structure, said composition being expressed by the following general formula (1):

$$\{Ln_{1-a}A_a\}\{B_xB'_yB''_z\}O_{(3-\delta)} \qquad (1)$$

where Ln represents one or a combination of elements selected from the group of Y and lanthanoids;

A represents one or a combination of elements selected from the group of Ba, Sr, and Ca;

B represents one or a combination of elements selected from the group of Co, Fe, Cr, and Ga, B always containing Fe, the molar number of Co being within the range of 0% to 10% of the total molar number of Fe, the sum of the molar numbers of Cr and Ga being within the range of 0% to 20% of the total molar number x of B;

B' represents one or a combination of elements selected from the group of Nb, Ta, Ti, and Zr, B' always containing Nb or Ta, the sum of the molar numbers of Ti and Zr being within the range of 0% to 20% of the total molar number y and B';

B" represents one or a combination of elements selected from the group of Zn, Li, and Mg;

$0.8 \leq a \leq 1; 0 < x; 0 < y \leq 0.5; 0 \leq z \leq 0.2$

$0.98 \leq x + y + z \leq 1.02$; and

δ represents a value which is so determined as to meet charge neutralization conditions; and

[providing] forming a sintered film portion including a gastight dense continuous layer of a mixed conducting oxide [formed] on said porous body portion, wherein the maximum [heat treatment] sintering temperature for said mixed conducting oxide of porous body portion [includes sintering at a higher] is greater than the maximum sintering temperature [than that of] for said dense continuous layer.